Please add the following new claims:

110. An array of polynucleotides comprising:

(a) a two-dimensional grating comprising a material having a high refractive index;

(b) a substrate layer that supports the two-dimensional grating;

(c) one or more types of polynucleotides attached at distinct locations of the two-dimensional grating opposite the support layer;

wherein, when the array of polynucleotides is illuminated a resonant grating effect is produced on the reflected radiation spectrum, wherein the depth and period of the two-dimensional grating are less than the resonant grating effect wavelength, and wherein the binding of a specific binding substance to the one or more types of polynucleotides attached at distinct locations to the two-dimensional grating produces a detectable change in the resonant grating effect on the reflected radiation spectrum.

111. The array of polynucleotides of claim 110, wherein a narrow band of optical wavelengths is reflected from the array when the array is illuminated with a broad band of optical wavelengths.

112. The array of polynucleotides of claim 110, wherein the substrate comprises glass, plastic or epoxy.

113. The array of polynucleotides of claim 110, wherein the two-dimensional grating is comprised of a material selected from the group consisting of zinc sulfide, titanium dioxide, tantalum oxide and silicon nitride.

114. The array of polynucleotides of claim 110, wherein the substrate and the two-dimensional grating comprise a single unit, wherein the surface of the single unit comprising the two-dimensional grating is coated with a material having a high refractive index.

115. The array of polynucleotides of claim 114, wherein the single unit is comprised of a material selected from the group consisting of glass, plastic and epoxy.

116. The array of polynucleotides of claim 114, wherein the material having a high refractive index is selected from the group consisting of zinc sulfide, titanium dioxide, tantalum oxide and silicon nitride.

117. The array of polynucleotides of claim 110, wherein the two-dimensional grating is comprised of a repeating pattern of shapes selected from the group consisting of squares, circles, ellipses, triangles, trapezoids, sinusoidal waves, ovals, rectangles and hexagons.

118. The array of polynucleotides of claim 117, wherein the repeating pattern of shapes are arranged in a rectangular grid or hexagonal grid.

119. The array of polynucleotides of claim 110, wherein the two-dimensional grating has a period of about 0.01 microns to about 1 micron and a depth of about 0.01 microns to about 1 micron.

120. The array of polynucleotides of claim 110, further comprising an antireflective physical structure that is embossed into a surface of the substrate opposite of the two-dimensional grating.

121. The array of polynucleotides of claim 120, wherein the antireflective physical structure is a motheye structure.

122. A detection system comprising the array of polynucleotides of claim 110, a light source that directs light to the array of polynucleotides, and a detector that detects light reflected from the array of polynucleotides.

123. The detection system of claim 122, further comprising a fiber probe comprising one or more illuminating optical fibers that are connected at a first end to the light source, and one or more collecting optical fibers connected at a first end to the detector, wherein the second ends of the illuminating and collecting fibers are arranged in line with a collimating lens that focuses light onto the array of polynucleotides.

124. The detection system of claim 123, wherein the illuminating fiber and the collecting fiber are the same fiber.

125. The detection system of claim 122, wherein the light source illuminates the array of polynucleotides from its top surface or from its bottom surface.

126. An array of polynucleotides comprising:

(a) a sheet material having a first and second surface, wherein the first surface defines relief volume diffraction structures; and

(b) a reflective material coated onto the first surface of the sheet material;

(c) one or more types of polynucleotides attached at distinct locations to the reflective material;

wherein the array of polynucleotides is capable of reflecting light predominantly at a first single optical wavelength when illuminated with a broad band of optical wavelengths as a result of optical interference, and wherein binding of a specific binding substance to the one or more types of polynucleotides attached at distinct locations to the reflective material produces a detectable change in the wavelength of reflected light.

127. The array of polynucleotides of claim 126, further comprising a light source that directs light to the reflective surface and a detector that detects light reflected from the reflective surface.

128. The array of polynucleotides of claim 126, wherein the relief volume diffraction structures are about 0.5 microns to about 5 microns in diameter.

129. An array of polynucleotides comprising:

(a) a two-dimensional grating comprising a material having a high refractive index;

(b) a substrate layer that supports the two-dimensional grating;

(c) a cover layer on a surface of the two-dimensional grating opposite of the substrate layer;

(d) one or more types of polynucleotides attached at distinct locations to the cover layer,

wherein, when the array is illuminated a resonant grating effect is produced on the reflected radiation spectrum, wherein the depth and period of the two-dimensional grating are less than the resonant grating effect wavelength, and wherein binding of a specific binding substance to the one or more types of polynucleotides attached at distinct locations to the cover layer produces a detectable change in the resonant grating effect on the reflected radiation spectrum.

130. The array of polynucleotides of claim 129, wherein a narrow band of optical wavelengths is reflected from the optical device when the array is illuminated with a broad band of optical wavelengths.

131. The array of polynucleotides of claim 129, wherein the substrate comprises glass, plastic or epoxy.

132. The array of polynucleotides of claim 129, wherein the two-dimensional grating is comprised of a material selected from the group consisting of zinc sulfide, titanium dioxide, tantalum oxide and silicon nitride.

133. The array of polynucleotides of claim 129, wherein the substrate and the two-dimensional grating comprise a single unit, wherein the surface of the single unit comprising the two-dimensional grating is coated with a material having a high refractive index and the material having a high refractive index is coated with a cover layer.

134. The array of polynucleotides of claim 133, wherein the single unit is comprised of a material selected from the group consisting of glass, plastic, and epoxy.

135. The array of polynucleotides of claim 133, wherein the material having a high refractive index is selected from the group consisting of zinc sulfide, titanium dioxide, tantalum oxide and silicon nitride.

136. The array of polynucleotides of claim 129, wherein the cover layer comprises a material that has a lower refractive index than zinc sulfide, titanium dioxide, tantalum oxide or silicon nitride.

137. The array of polynucleotides of claim 136, wherein the cover layer comprises a material selected from the group consisting of glass, epoxy and plastic.

138. The array of polynucleotides of claim 129, wherein the two-dimensional grating is comprised of a repeating pattern of shapes selected from the group consisting of squares, circles, ellipses, triangles, trapezoids, sinusoidal waves, ovals, rectangles and hexagons.

139. The array of polynucleotides of claim 138, wherein the repeating pattern of shapes are arranged in a rectangular grid or hexagonal grid.

140. The array of polynucleotides of claim 129, wherein the two-dimensional grating has a period of about 0.01 microns to about 1 micron and a depth of about 0.01 microns to about 1 micron.

141. The array of polynucleotides of claim 129, further comprising an antireflective physical structure that is embossed into a surface of the substrate opposite of the two-dimensional grating.

142. The array of polynucleotides of claim 141, wherein the antireflective physical structure is a motheye structure.

143. A detection system comprising the array of polynucleotides of claim 129, a light source that directs light to the array of polynucleotides, and a detector that detects light reflected from the array of polynucleotides.

144. The detection system of claim 143, further comprising a fiber probe comprising one or more illuminating optical fibers that are connected at a first end to the light source, and one or more collecting optical fibers connected at a first end to the detector, wherein the second ends of the illuminating and collecting fibers are arranged in line with a collimating lens that focuses light onto the array of polynucleotides.

145. The detection system of claim 144, wherein the illuminating fiber and the collecting fiber are the same fiber.

146. The detection system of claim 143, wherein the light source illuminates the array of polynucleotides from its top surface or from its bottom surface.

147. An array of polynucleotides device comprising:

(a) a sheet material having a first and second surface, wherein the first surface defines relief volume diffraction structures; and

(b) a reflective material coated onto the first surface of the sheet material;

(c) a cover layer on the surface of the reflective material coated onto the first surface of the sheet material;

(d) one or more types of polynucleotides attached at distinct locations to the cover layer,

wherein the array of polynucleotides is capable of reflecting light predominantly at a first single optical wavelength when illuminated with a broad band of optical wavelengths as a result of optical interference, and wherein the binding of a specific binding substance to the one or more types of polynucleotides attached at distinct locations of the cover layer produces a detectable change in the wavelength of reflected light.

148. The array of polynucleotides of claim 147, further comprising a light source that directs light to the reflective surface and a detector that detects light reflected from the reflective surface.

149. The array of polynucleotides of claim 147, wherein the relief volume diffraction structures are about 0.5 microns to about 5 microns in diameter.

150. A method of detecting the binding of one or more specific binding substances to their respective unlabeled binding partners comprising:

(a) applying one or more unlabeled binding partners to a biosensor comprising:

(1) a two-dimensional grating comprised of a material having a high refractive index;

(2) a substrate layer that supports the two-dimensional grating; and

(3) one or more specific binding substances immobilized on the surface of the two-dimensional grating opposite of the substrate layer; wherein, when the biosensor is illuminated a resonant grating effect is produced on the reflected radiation spectrum, and wherein the depth and period of the two-dimensional grating are less than the wavelength of the resonant grating effect;

(b) illuminating the biosensor with light; and

(c) detecting a maxima in reflected wavelength, or a minima in transmitted wavelength of light from the biosensor;

wherein, if the one or more specific binding substances have bound to their respective binding partners, then the reflected wavelength of light is shifted.

151. A method of detecting the binding of one or more specific binding substances to their respective unlabeled binding partners comprising:

(a) applying one or more unlabeled binding partners to a biosensor comprising

(1) a two-dimensional grating comprised of a material having a high refractive index;

(2) a substrate layer that supports the two-dimensional grating; and

(3) one or more specific binding substances immobilized on a surface of the two-dimensional grating opposite of the substrate layer; wherein, when the biosensor is illuminated a resonant grating effect is produced on the reflected radiation spectrum, wherein the depth and period of the two-dimensional grating are less than the wavelength of the resonant grating effect, and wherein the two-dimensional grating is coated with an array of distinct locations containing the one or more specific binding substances;

(b) illuminating each distinct location of the biosensor with light; and

(c) detecting maximum reflected wavelength or minimum transmitted wavelength of light from each distinct location of the biosensor;

wherein, if the one or more specific binding substances have bound to their respective unlabeled binding partners at a distinct location, then the reflected wavelength of light is shifted.

152. A method of detecting binding of one or more specific binding substances to their respective unlabeled binding partners comprising:

(a) illuminating a surface-relief volume diffractive structures (SRVD) biosensor with light and detecting reflected wavelength of light from the biosensor;

(b) applying one or more unlabeled binding partners to the SRVD biosensor;

(c) illuminating the biosensor with light and detecting reflected wavelength of light from the biosensor;

wherein, if the one or more specific binding substances have bound to their respective unlabeled binding partners, then the reflected wavelength of light is shifted.

153. A method of detecting the binding of one or more specific binding substances to their respective unlabeled binding partners comprising:

(a) illuminating a SRVD biosensor with light and detecting reflected wavelength of light from the biosensor;

(b) applying one or more unlabeled binding partners to the SRVD biosensor, wherein the one or more specific binding substances are arranged in an array of distinct locations on the SRVD biosensor;

(b) illuminating each distinct location of the SRVD biosensor with light and detecting reflected wavelength of light from each distinct location of the SRVD biosensor;

wherein, if the one or more specific binding substances have bound to their respective unlabeled binding partners at a distinct location, then the reflected wavelength of light is shifted.

Remarks

Claim 6 has been amended to change the word "and" to "or". The amendment is made for clarity and does not narrow the scope of the claim in any manner. New claims